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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/880,733	06/12/2001	Tasao Soga	16869S-027500US	4951

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EXAMINER

ANDUJAR, LEONARDO

ART UNIT	PAPER NUMBER
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2826

DATE MAILED: 06/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/880,733

Applicant(s)

SOGA ET AL.

Examiner

Leonardo Andújar

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 02 May 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-3, 10, 14 and 15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3, 10, 14 and 15 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 7,8,12.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

NATHAN J. FLYNN  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800

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## **DETAILED ACTION**

### ***Election/Restrictions***

1. Applicant's election without traverse of embodiment 12 in Paper No. 15 is acknowledged.

### ***Acknowledgment***

2. The amendment filed on 05/02/2003, paper no. 15, in response to the Office action mailed on 03/12/2003 has been entered. The present Office action is made with all the suggested amendments being fully considered. Accordingly, pending in this Office action are claims 1-3, 14 and 15.

### ***Priority***

3. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

### ***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 14 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter that was not described in the specification in such a way as to enable one skilled in the art to which it

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pertains, or with which it is most nearly connected, to make and/or use the invention. According to applicant claim 14 reads on embodiment 12 which correspond to figures 7'. In that regards the specification does not support the following recitation "*another face of said semiconductor chip and said substrate being bonded to each other through bonding portions each containing Cu balls and Cu<sub>6</sub>Sn<sub>5</sub> compound*". Note that figure 7 shows that semiconductor chip 13 (i.e. wired chip) and the substrate are bonded by a single bonding portion 27 and not by bonding portions.

7. Claims 1, 10 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

8. Claim 1 recites the limitation "**a substrate provided with pads on which substrate said semiconductor device is mounted**" in lines 2-3. This recitation renders the claim indefinite since the organizational arrangement of the device elements cannot be properly established.

9. Claim 10 recites the limitation "**a first substrate provided with pads on which substrate said semiconductor device is mounted, and a second substrate provided with pads on which second substrate said first substrate is mounted**" in lines 2-4. This recitation renders the claim indefinite since the organizational arrangement of the device elements cannot be properly established.

#### ***Claim Rejections - 35 USC § 103***

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

12. Claims 1-3, 10, 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iwasaki (US 5,834,848) in view of Shojikuo (JP 11044016, cited by applicant) further in view of Iino et al. (US 6,207, 259).

13. Regarding claim 1 (as understood), Iwasaki (e.g. fig. 6) shows an electronic device comprising a semiconductor device 11 provided with pads 11a and a substrate provided with pads 12a on which the semiconductor device is mounted. Also, Iwasaki shows that the semiconductor device's pads and the substrate's pads are bonded by solder bumps 13. Iwasaki does not suggest that the bumps can be made from Cu balls bonded to each other by the Cu-Sn compounds including at least  $\text{Cu}_6\text{Sn}_5$ . Shojikuo discloses a leadless solder paste including an intermetallic compound and an amorphous phase. Also, Shojikuo discloses that Cu/Sn is a suitable combination. According this leadless paste has a low melting point, the excellent safety of soldering

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work and does not adversely affect the environment at the time of disposal (abstract). Although Shojikuo does not list all possible Cu/Sn intermetallic compounds it well known in the art that Cu/Sn intermetallic compounds include  $\text{Cu}_3\text{Sn}_6$  and/ or  $\text{Cu}_6\text{Sn}_5$ . For example, lino teaches that  $\text{Cu}_3\text{Sn}_6$  and  $\text{Cu}_6\text{Sn}_5\text{C}$  are the Cu/Sn intermetallic compounds. According to lino a  $\text{Cu}_6\text{Sn}_5/\text{Cu}_3\text{Sn}_6$  ratio of not higher than 0.65 improves the electric and heat resistance properties of the alloy (col. 3/ll. 63-col. 4/ll. 34). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the solder bumps disclosed by Iwasaki using a leadless paste having Cu balls bonded together by Cu-Sn intermetallic compounds since this type of paste has a low melting point and the excellent safety of soldering work without adversely affecting the environment at the time of disposal as taught by Shojikuo and to include Cu/Sn intermetallic compounds in a ratio ( $\text{Cu}_6\text{Sn}_5/\text{Cu}_3\text{Sn}_6$ ) lower than 0.65 in the solder paste disclosed by Iwasaki in view of Shojikuo in order to improve the electric property and heat resistance of the alloy as taught by lino.

14. Regarding claim 2, Shojikuo the mixture may include In, Zn and Bi (abstract).

15. Regarding claim 3, Shojikuo discloses that the junction has plastic balls e.g. copper powder.

16. Regarding claim 10 (as understood), Iwasaki (e.g. fig. 1) shows an electronic device comprising a semiconductor device 11 having pads 11a, a first substrate having pads 12a on which the semiconductor device is mounted and a second substrate 21 provided with pads 21a on which the first substrate is mounted. Also, the pads of the semiconductor device are bonded to the pads of the first substrate through solder

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bumps 13 and the pads of the first substrate are bonded to the pads of the second substrate by solder bumps 31. Iwasaki does not suggest that the bumps (13, 31) can be made from Cu balls bonded to each other by the Cu-Sn compounds including at least  $\text{Cu}_6\text{Sn}_5$ . Shojikuo discloses a leadless solder paste that may include an intermetallic compound and an amorphous phase. Also, Shojikuo discloses that Cu-Sn, Sn-Ag and Sb-Zn are suitable combinations. According to Shojikuo this leadless paste has a low melting point, the excellent safety of soldering work and does not adversely affect the environment at the time of disposal (abstract). Although Shojikuo does not list all possible Cu-Sn intermetallic compounds it well known in the art that Cu/Sn intermetallic compounds include  $\text{Cu}_3\text{Sn}_6$  and/ or  $\text{Cu}_6\text{Sn}_5$ . For example, lino teaches that  $\text{Cu}_3\text{Sn}_6$  and  $\text{Cu}_6\text{Sn}_5\text{C}$  are the Cu-Sn intermetallic compounds. According to lino a  $\text{Cu}_6\text{Sn}_5/\text{Cu}_3\text{Sn}_6$  ratio of not higher than 0.65 improves the electric and heat resistance properties of the alloy (col. 3/ll. 63-col. 4/ll. 34). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the solder bumps disclosed by Iwasaki using a leadless paste having Cu balls bonded together by Cu-Sn intermetallic compounds or using other mixtures such as Sn-Ag and Sb-Zn since this type of paste has a low melting point and the excellent safety of soldering work without adversely affecting the environment at the time of disposal as taught by Shojikuo and to include Cu/Sn intermetallic compounds in the solder paste disclosed by Iwasaki in view of Shojikuo at a ratio ( $\text{Cu}_6\text{Sn}_5/\text{Cu}_3\text{Sn}_6$ ) not greater than 0.65 in order to improve the electric property and heat resistance of the alloy as taught by lino.

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17. Regarding claim 14 (as understood), Iwasaki (e.g. fig. 10) shows an electronic device comprising a semiconductor chip 91 provided with connection terminals 91a on one face, and a substrate 92 provided with connection terminals 92a on which the semiconductor terminals is connected and wires 96 bonding the connection terminals of the substrate to the connection terminals of the semiconductor chip. Also, Iwasaki discloses that another face of the semiconductor chip and the substrate are bonded to each other through bonding portions 95 (col. 2/lis.18-51). Nonetheless, Iwasaki does not disclose that the bonding portion or adhesive means can be made from Cu balls bonded to each other by the Cu-Sn compounds including at least  $\text{Cu}_6\text{Sn}_5$ . Shojikuo discloses a leadless solder paste or an adhesive means that may include an intermetallic compound and an amorphous phase. Also, Shojikuo discloses that Cu-Sn, Sn-Ag and Sb-Zn are suitable combinations. According to Shojikuo this leadless paste has a low melting point, the excellent safety of soldering work and does not adversely affect the environment at the time of disposal (abstract). Although Shojikuo does not list all possible Cu-Sn intermetallic compounds it well known in the art that Cu/Sn intermetallic compounds include  $\text{Cu}_3\text{Sn}_6$  and/ or  $\text{Cu}_6\text{Sn}_5$ . For example, Iino teaches that  $\text{Cu}_3\text{Sn}_6$  and  $\text{Cu}_6\text{Sn}_5\text{C}$  are the Cu-Sn intermetallic compounds. According to Iino a  $\text{Cu}_6\text{Sn}_5/\text{Cu}_3\text{Sn}_6$  ratio of not higher than 0.65 improves the electric and heat resistance properties of the alloy (col. 3/ll. 63-col. 4/ll. 34). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the bonding portion or adhesive means disclosed by Iwasaki using a leadless paste having Cu balls bonded together by Cu-Sn intermetallic compounds since this type of paste has a low melting



point and the excellent safety of soldering work without adversely affecting the environment at the time of disposal as taught by Shojikuo and to include Cu/Sn intermetallic compounds in the solder paste disclosed by Iwasaki in view of Shojikuo at a ratio ( $\text{Cu}_6\text{Sn}_5/\text{Cu}_3\text{Sn}_6$ ) not greater than 0.65 in order to improve the electric property and heat resistance of the alloy as taught by Iino.

18. Regarding claim 15, Iwasaki discloses that the substrate comprises connection terminals or bumps 103 on a rear face regarding a face provide with the connection terminals. Iwasaki does not suggest that the bumps 130 can be made of one selected from the group consisting of Cu-Sn, Sn-Ag and Sn-Zn base solder. Shojikuo discloses a leadless solder paste made of one selected from the group consisting Cu-Sn, Sn-Ag and Sb-Zn. According to Shojikuo this leadless paste has a low melting point, the excellent safety of soldering work and does not adversely affect the environment at the time of disposal (abstract). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make the solder bumps disclosed by Iwasaki using a leadless paste made of one selected from the group consisting Cu-Sn, Sn-Ag and Sb-Zn Sn-Ag since this type of paste has a low melting point and the excellent safety of soldering work without adversely affecting the environment at the time of disposal as taught by Shojikuo.

#### **Conclusion**

19. Papers related to this application may be submitted directly to Art Unit 2826 by facsimile transmission. Papers should be faxed to Art Unit 2826 via the Art Unit 2826 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must

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conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2826 Fax Center number is **(703) 308-7722** or **-7724**. The Art Unit 2826 Fax Center is to be used only for papers related to Art Unit 2826 applications.

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Leonardo Andújar** at **(703) 308-0080** and between the hours of 9:00 AM to 7:30 PM (Eastern Standard Time) Monday through Thursday or by e-mail via [Leonardo.Andujar@uspto.gov](mailto:Leonardo.Andujar@uspto.gov). If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn, can be reached on (703) 308-6601.

21. Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 305-3900**.

22. The following list is the Examiner's field of search for the present Office Action:

Field of Search	Date
U.S. Class / Subclass (es): 257/783, 779, 738, 772, 780, 782	05/03
Other Documentation:	
Electronic Database(s): East (USPAT, US PGPUB, JPO, EPO, Derwent, IBM TDB)	05/03

**Leonardo Andújar**

Patent Examiner Art Unit 2826

LA

5/22/03